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(74) Agents Lewis W. Goold & Co.

(54) Turbulators

(57) A turbulator for insertion in a heat exchange tube to increase the turbulence of fluid flowing through the tube comprises a twisted wire member which has loop or coiled portions, extending along the length of the tube axis, of high density alternating with portions of low or nil density.

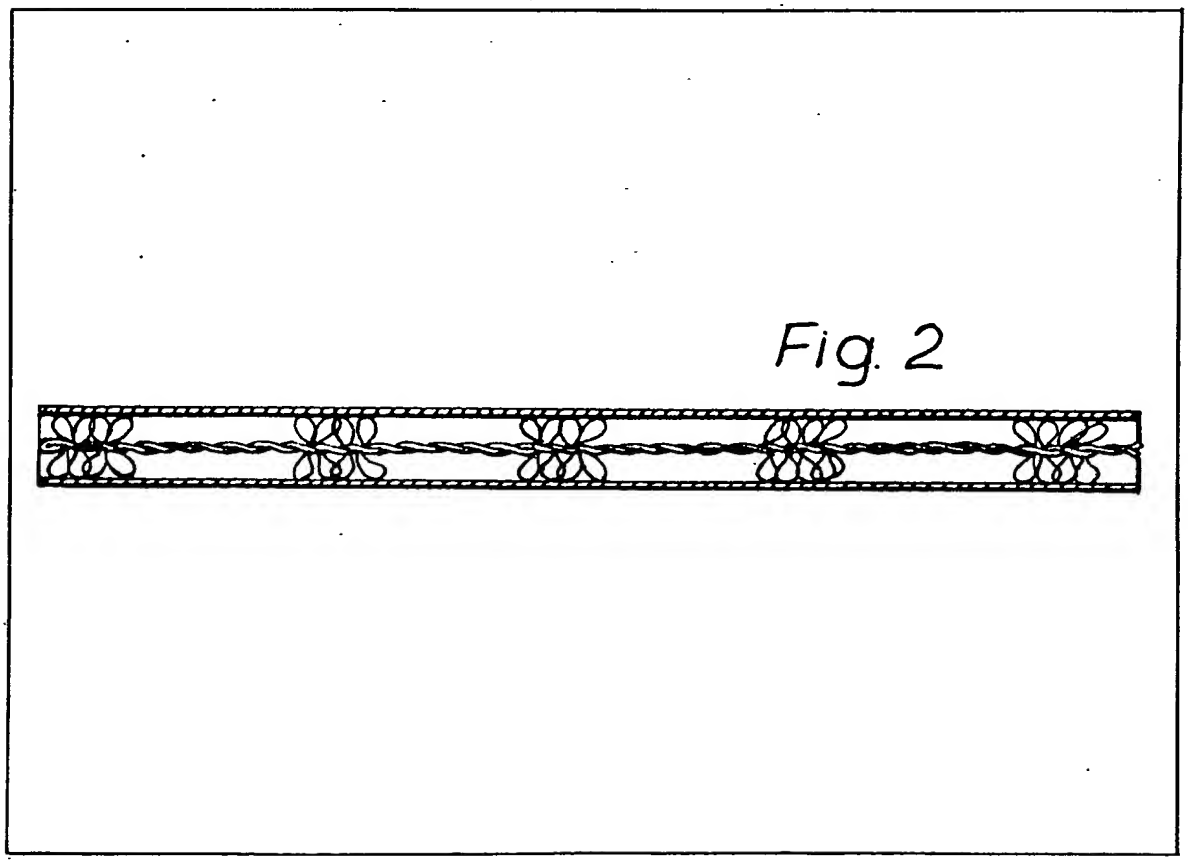

Fig. 2

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Fig. 1

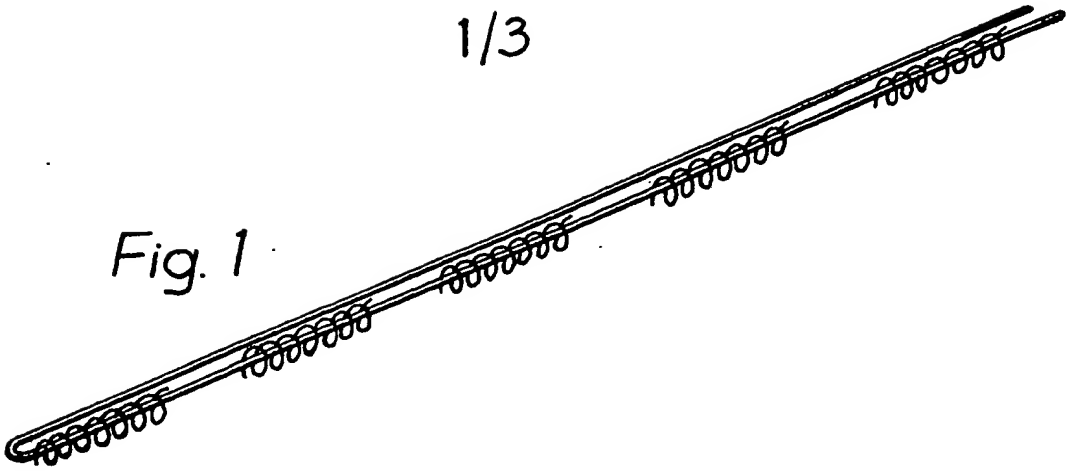


Fig. 2

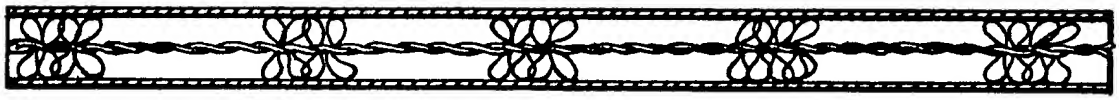


Fig. 3

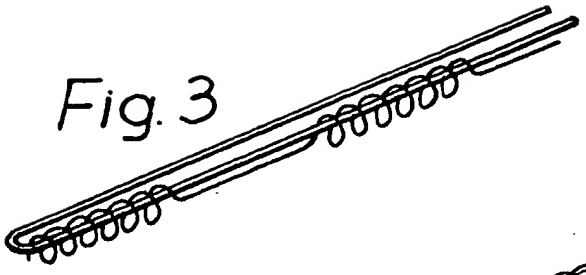
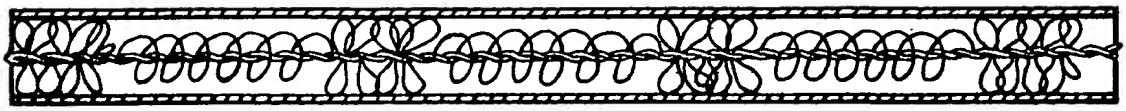


Fig. 4

Fig. 5



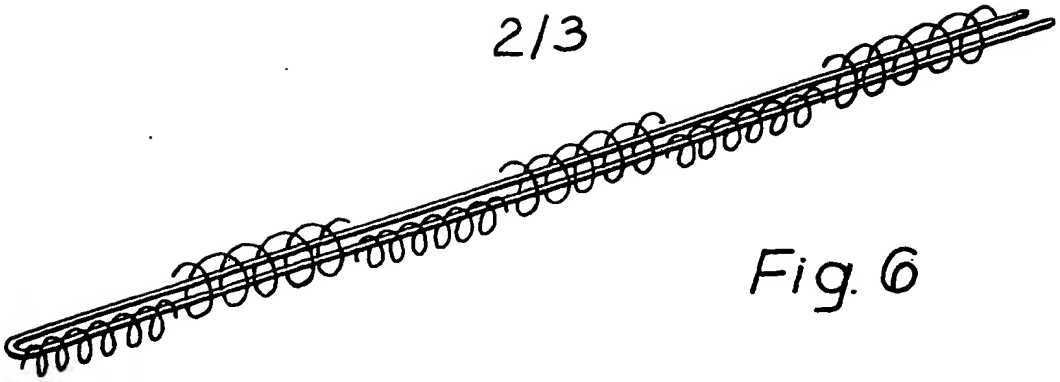


Fig. 6

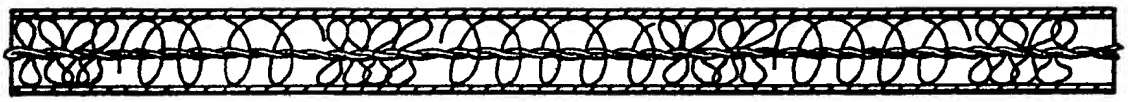


Fig. 7

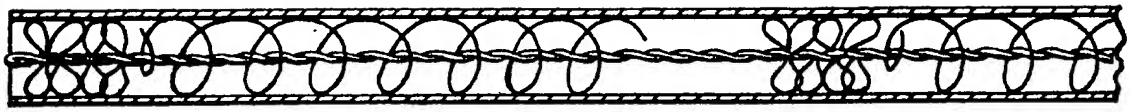


Fig. 8

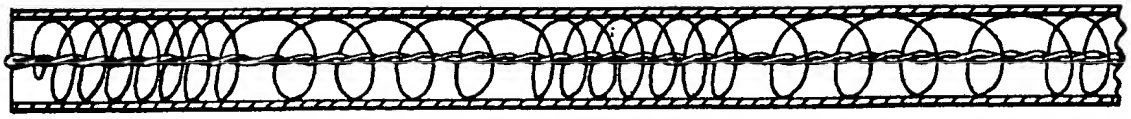


Fig. 9

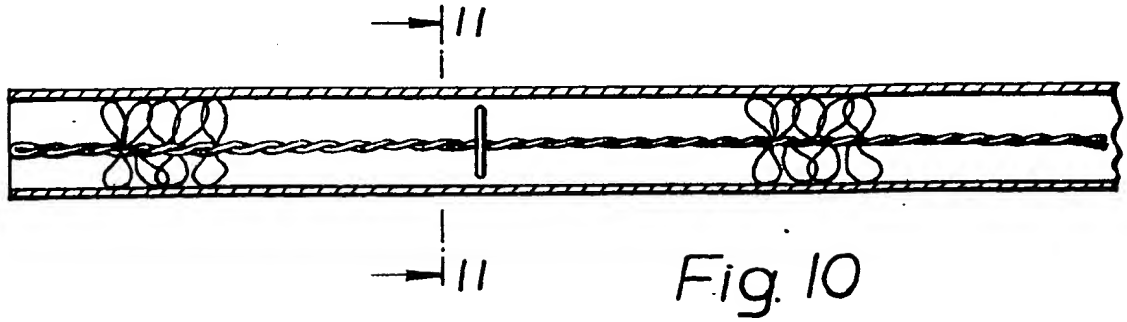


Fig. 10

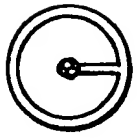


Fig. 11

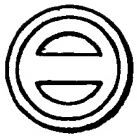


Fig. 12

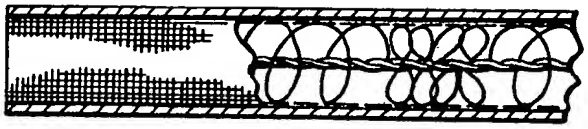


Fig. 13

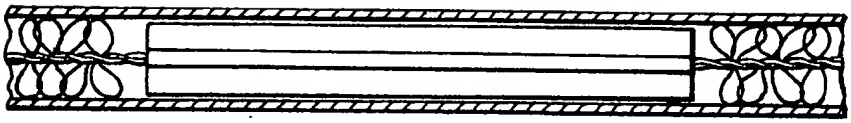


Fig. 14

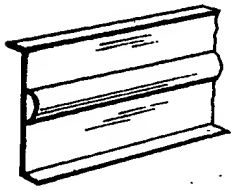


Fig. 15

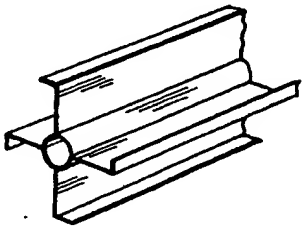


Fig. 16

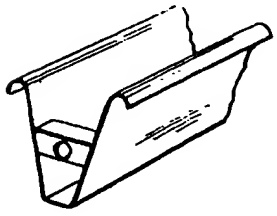


Fig. 17

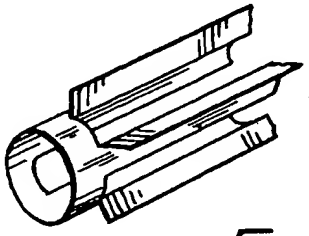


Fig. 18

SPECIFICATION
Turbulators

This invention relates to turbulators, which are inserts for location in tubes forming flow passages for fluids (and that term is used herein to mean liquids, air, vapours, gases and mixtures and which are primarily intended — as the name suggests — for creating turbulence so as, for example, improve heat exchange between the fluid and the tube wall, or promote mixing in the fluid.

In accordance with the invention, a turbulator comprises an elongate member provided along its length with wire or like loops having the function of creating turbulence in fluid flow past the loops, characterised in that the loops are provided along portions which alternate along the length of the member with interposed portions where the loops are at least of a different density.

The density may alternate between a high value and a nil value, or in other words, a looped portion may alternate with a portion not provided with loops; alternatively the density may alternate between high and low values, as by cyclically increasing and decreasing the number of loops per unit length along the member.

The loops may be effective to improve heat exchange in two ways namely by creating turbulence so as to improve heat exchange between the fluid and tube wall or by heat transfer between the loops and the tube wall. For the latter purpose the turbulators may be bonded to the tubes, or an interference fit to ensure thermal conductivity. In all cases the heat exchange may be to or from the fluid.

In a first embodiment of the invention, a turbulator is made by assembling a pair of heavy gauge wires in parallel relationship, and disposing a series of regularly spaced helically wound coils of lighter gauge wire so that they are threaded by one of the heavy gauge wires but not the other. This is shown in Figure 1. The two heavy gauge wires are then twisted together and this displaces the successive convolutions of the helically wound coils so that the convolutions spiral around the twisted core, the number of convolutions per unit length depending upon the parameters of the original coils and the degree of twisting. Figure 2 shows this assembled in a flow tube.

Instead of using separate coils which are individually spaced along the core wires before the twisting step, all of the helically wound coils may be made integral and unitary, each coiled portion being separated by a non-coiled portion of material of appropriate length as shown in Figure 3 to create the desired gap between the successive coils, and after the twisting step, the straight portion between successive coils will be twisted with the core.

In another embodiment, the space between successive ones of the helical coils is occupied by an additional helical coil which is not displaced by the core twisting step and hence does not go to the spirally located convolution condition when the core is twisted. This is shown in Figure 4 and may be done by arranging for both of the cores to be threaded through the additional coils in the assembly operation prior to the twisting operation. The additional coils may be provided as an integral part of a single component, which is to provide the coils which are to be twisted with the core and the coils which are not to be twisted with the core alternately along its length to produce the arrangement of Figure 5 or the two sets of coils may be made separately as in Figure 6 leading to the arrangement of Figure 7. Further, the coils may be of different diameters so that those which are to be twisted with the core form a spirally wound bundle of convolutions having an overall diameter which is generally the same as that of the coils which are not to be twisted; the latter is also shown in Figure 8.

One particular version of the arrangement discussed in the preceding paragraph is where each of the coils which is not to be twisted with the core has only a single end effectively anchored to the core, and the diameter may be such in relation to the heat exchanger or other tube in which the turbulator is to be used that upon insertion, there is a slight interference fit with the untwisted coils so that they elongate during the insertion opertion as also shown in Figure 8. In this case it will be appreciated that the length of the untwisted coils prior to assembly into the heat exchange or like tube will be less than the gap between adjacent ones of the coils which are to be twisted with the core.

In another embodiment, the untwisted helical coils which provide the low density turbulator effect as described above are used without the twisted and spirally located helical coils, and the variation in density is achieved by the spacing of the helical coils along individual convolutions as in Figure 9, thus enabling a single helical coil to be assembled to a core to provide the turbulator of the invention. The coil may be fixed to the core at one or both ends or at a series of spaced intervals along the length of the parts.

Instead of using wires for the core or for the coil or coils, strip material or other filamentary material may be used. Baffles may be provided, for example, made of metal pressings, which may be fixed to the core for example at each end and to act as spacers so as to locate the core on the axis of the tube in which the turbulator is to be located. Additional baffles may be located between successive coils as shown in Figure 10 and Figure 14, and may take the form of disc-like pressings with apertures therein, or wire rings, which can be of smaller diameter than the tube bore. The baffles may be fixed in place or e.g. free to rotate so as to promote turbulence with less pressure drop. Figures 11 and 12 are sections on the line 11—11 of Figure 10 showing two alternative designs of baffle, and Figures 15—18 show other forms of baffle.

The coils may be made of a plurality of wires, strips or other filaments which are collectively coiled, and during a twisting operation with the core respective coils will tend to separate from

one another, thus creating a greater number of flow passages through the turbulator. The wire or other material may be crimped to a non-linear condition prior to forming into the coils or like, or can be coiled to a smaller diameter before being formed into coiled coils of large diameter.

Particularly (but not exclusively) when the fluid is viscous, a knitted wire stocking or sleeve may be used to line the tube as in Figure 13 with the turbulator located in the sleeve and serving the additional function of holding the sleeve against the tube wall. This may prevent the formation of laminar layers of the fluid on the tube wall and hence improve heat transfer further.

CLAIMS

1. A turbulator comprising an elongate member provided along its length with wire or like loops having the function of creating turbulence in fluid flow past the loops, characterised in that the loops are provided along portions which alternate along the length of the member with interposed portions where the loops are at least of a different density.

2. A turbulator as claimed in Claim 1 wherein the density alternates between a high value and a nil value.

3. A turbulator as claimed in Claim 1 wherein the density alternates between a high and low values.

4. A turbulator substantially as described with reference to any of the Figures of the accompanying drawings.

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